Purpose: Intensity modulated radiotherapy (IMRT) requires the determination of the appropriate multileaf collimator (MLC) settings to deliver segmental fluence maps. In this study, we purposed a leaf sequencing algorithm to regulate the MLC aperture between adjacent apertures in the delivery.

Method and Materials: Based on the algorithm of Xia and Verhey, our proposed algorithm improved the shape of each MLC segment so that the basic frame can be preserved. The MLC aperture can be subjected to the distances of adjacent leaf rows based on the segmentation result of the algorithm of Xia and Verhey. As the row distances decreased, the distance value became smaller. The distance value between adjacent rows can be controlled by user to omit the low-weight monitor unit segments and tiny MLC segments. Conjugate Gradient algorithm was used to optimize segmental weight, and readjust segment and shape which can minimize the error in the anterior-posterior leaf sequencing.

Results: By comparisons and analyses of the total number of monitor unit and number of segment with benchmark results, our proposed algorithm performed well. The segmental aperture constraint produces segments with more compact shapes when delivering the planned fluence maps, which may help to reduce the MLC specific effects. As an improved leaf sequencing algorithm, Shape regulation was validated with a series of fluence maps using treatment planning system performed previously by the benchmark algorithm of Xia and Verhey.

Conclusions: Our improved algorithm performed a good agreement among the NS and TNMU value of the benchmark results and finished this segmentation in fraction of a second, faster than the DAO method. Moreover, it can keep the MLC aperture compact shapes. We concluded that our algorithm is acceptable as a module in IMRT treatment planning.

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